Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SHOUT
SHARE
IT

Ag84B
1245
rev.
1929

UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT BULLETIN No. 1245
Rev. 10/29

Washington, D. C.

Issued December 22, 1924
Revised October, 1929

# STOCK-POISONING PLANTS OF THE RANGE

By

C. D. MARSH, Physiologist
In Charge of Investigations of Stock Poisoning by Plants,
Pathological Division, Bureau of Animal Industry

CONTENTS

| | Page | | Page |
|---|---|---|---|
| Prefatory Note | 1 | The Pulse Family | 22 |
| Introduction | 2 | The Buckthorn Family | 44 |
| The Grass Family | 5 | The Parsley Family | 46 |
| The Arrow-Grass Family | 7 | The Heath Family | 48 |
| The Lily Family | 7 | The Milkweed Family | 54 |
| The Beech Family | 10 | The Nightshade or Potato Family | 59 |
| The Goosefoot Family | 11 | The Aster Family | 59 |
| The Crowfoot Family | 11 | The Fern Family | 69 |
| The Rose Family | 21 | Prevention of Losses | 70 |

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 35 cents

UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT BULLETIN No. 1245

Washington, D. C.

Issued December 22, 1924
Revised October, 1929

# STOCK-POISONING PLANTS OF THE RANGE[1]

By C. D. MARSH, *Physiologist in Charge of Investigations of Stock Poisoning by Plants, Pathological Division, Bureau of Animal Industry*

CONTENTS

| | Page |
|---|---|
| Prefatory note | 1 |
| Introduction | 2 |
| The grass family (Poaceae) | 5 |
| Sleepy grass (*Stipa vaseyi*) | 5 |
| The arrow-grass family (Juncaginaceae) | 7 |
| Arrow grass (*Triglochin maritima*) | 7 |
| The lily family (Liliaceae) | 7 |
| Death camas (species of Zygadenus) | 7 |
| The beech family (Fagaceae) | 10 |
| Oak (species of Quercus) | 10 |
| The goosefoot family (Chenopodiaceae) | 11 |
| Greasewood (*Sarcobatus vermiculatus*) | 11 |
| The crowfoot family (Ranunculaceae) | 11 |
| Larkspurs (species of Delphinium) | 11 |
| The rose family (Rosaceae) | 21 |
| Chokecherry (species of Prunus) | 21 |
| The pulse family (Fabaceae) | 22 |
| Lupines (species of Lupinus) | 22 |
| Poison bean (*Daubentonia drummondii*) | 23 |
| Loco weeds (species of Oxytropis and Astragalus) | 24 |
| Species of Astragalus, poisonous but not true locoes | 32 |
| Nontoxic plants suspected of being locoes | 38 |
| The buckthorn family (Rhamnaceae) | 44 |
| Coyotillo (*Karwinskia humboldtiana*) | 44 |
| The parsley family (Apiaceae) | 46 |
| Water hemlock (species of Cicuta) | 46 |
| The heath family (Ericaceae) | 48 |
| The milkweed family (Asclepiadaceae) | 54 |
| Milkweed (species of Asclepias) | 54 |
| The nightshade or potato family (Solanaceae) | 59 |
| The aster family (Asteraceae) | 59 |
| Cocklebur (species of Xanthium) | 59 |
| Western sneezeweed (*Helenium hoopesii*) | 61 |
| *Baccharis ramulosa* | 63 |
| Parry aster (*Xylorrhiza parryi*) | 67 |
| Colorado rubber weed (*Actinea richardsonii*) | 67 |
| Rayless goldenrod (*Aplopappus heterophyllus*) | 67 |
| The fern family (Polypodiaceae) | 69 |
| Bracken (*Pteridium aquilinum*) | 69 |
| Prevention of losses | 70 |

## PREFATORY NOTE

It is well known that poisonous plants cause heavy losses of range animals. Statistics in regard to these losses are not available, but from estimates made in many localities it seems probable that the average animal loss must be as great as 3 to 5 per cent, while in some range States it rises to much higher figures. For example, it has been estimated that in Colorado the losses amount to a million dollars annually, while sheep growers in Wyoming have estimated their annual loss at 14.6 per cent. These losses, too, are to a large extent of mature animals, those that are ready or nearly ready for the market, for the rearing of which large sums have already been spent.

The importance of these severe losses has been recognized by the United States Department of Agriculture, and extended investigations and experiments have been undertaken to determine what plants were poisonous and under what conditions poisoning took place, and to formulate methods for preventing these deaths. This work has involved prolonged study, and is still in progress. Some very definite results have been obtained, however, and it has been shown that

[1] This bulletin supersedes Department Bulletin 575, issued in 1918.

the heaviest losses are due to a comparatively small number of plants. If the stockmen and herders can recognize these plants and will act on the information contained in the bulletins which have been published on the subject, there is no doubt that most of these losses can be avoided.

This bulletin has been prepared with special reference to the needs of livestock producers. It was realized that many stockmen are not botanists and might not recognize plants through a technical description. In order to assist in recognition, many of the pictures of plants have been reproduced in colors.[2]

This is not intended as a complete manual of the subject. For detailed information other publications should be consulted. The United States Department of Agriculture has issued a considerable number of publications relating to specific plants.

Plates 3, 8, 12, 31, 32, and 38 are from paintings by F. A. Walpole, in the collection of the United States National Herbarium.

J. R. MOHLER, *Chief of Bureau.*

## INTRODUCTION

Poisonous plants have been the cause of heavy losses among livestock on the range. Stockmen generally have recognized the fact, but comparatively little has been done to avoid the losses. The first intimation of trouble has ordinarly been the finding of the carcasses, and while the men handling the stock have felt reasonably sure that certain plants were responsible, their knowledge of the plants was very meager, and the evidence against any particular plant was frequently insufficient. It was noticed that these losses were more apt to occur in certain seasons than in others, and in some cases it was assumed that the plant was more poisonous at some stages of growth than at others. Many of the stockmen were entirely uncertain as to what plant caused the damage, and it was common to speak, in a general way, of the source of the trouble as "poison weed," without any very definite idea as to what particular weed was responsible for the loss. Moreover, the investigations which have been carried out on the subject of range poisoning plants have necessarily been somewhat narrow in scope. There is a popular misconception in regard to the quantity of a poisonous plant necessary to produce illness. It seems to be the general belief that any plant possessing poisonous properties must be violently toxic. It is not unusual to hear stories of poisoning of domestic animals by a very few leaves of a poisonous plant. As a matter of fact, most of the stock-poisoning plants in the United States produce illness only when eaten in considerable quantity. This explains why so many experimental tests of animals with poisonous plants have failed, since some of these plants can be eaten with no apparent harm, provided the quantity eaten at any one time is not sufficient to produce toxic effects.

Many of the problems of plants poisonous to livestock seem to be largely peculiar to North America. Although similar plants occur in the eastern continents, very little information can be drawn from European sources to aid the American stockman.

For several years the United States Department of Agriculture has been carrying on a series of experiments with poisonous plants, and

[2] F. V. Coville, of the Bureau of Plant Industry, has read the manuscript with special reference to the identification of the plants and to the common names which should be applied to them.

has accumulated a considerable body of information, which, although necessarily incomplete, will be, it is hoped, of service to men handling livestock on the open range.

It appears from these researches that, while the total number of poisonous plants growing in the West may be very large, the number to be dreaded by the stockmen is comparatively small, and in most cases it is not difficult to identify the plants which are to be avoided. Of course, most stockmen are not botanists and are not interested in the botanical distinctions of plants. Most of them, however, are good observers and can readily recognize these plants if the salient characteristics are brought before them in a manner which they can understand.

With the continued reduction of the area of stock ranges and the increasing value of livestock, the owners are of necessity handling the animals with greater care. The time has passed when a man can buy a few cows, turn them loose, and pay no more attention to them except to brand the calves and occasionally round up a few of them for market. It is becoming necessary for stock owners to be in constant touch with their animals on the range, and it is no longer probable that a large number will die and the fact become known to the owner only after the lapse of weeks or months. Most of the mountain stock ranges at the present time are under the general direction of the Forest Service, and its officers are constantly patrolling the territory under their direction, so that between this supervision and the riding by the employees of the stock owners, cattle and horses on the range are kept under almost constant observation. Sheep, of course, have always been under the immediate care of a herder, and probably will continue to be attended to in the same general way.

Extensive acquaintance by the author with the conditions on the western ranges has shown that while harmful plants are known and avoided by some men, there are large regions in which these plants have never been recognized, in spite of the fact that losses have occurred year after year.

The object of this publication is to present in a brief form such a description of the common or more important plants as can be understood by a person not in the habit of using technical terms. With this description is given a brief statement of the symptoms produced by the plant, the time at which the losses may be expected to occur, and the means, so far as they are known, of avoiding them. It is not intended to give any complete description of the plants or their effects. For this, reference must be made to the more detailed reports upon specific plants. In regard to most of these our knowledge is at present on a firm basis of experimental proof. It has seemed best, however, to add to the list some plants which undoubtedly produce poisonous effects, but have never been subjected to detailed experimental study.

There are many other plants which, under some conditions, may cause sickness or death, but it has been thought best to limit the descriptions to those which are widely distributed and especially important.

SLEEPY GRASS (STIPA VASEYI)

A large, coarse grass especially affecting horses.

## THE GRASS FAMILY (POACEAE)

### SLEEPY GRASS (STIPA VASEYI)

Sleepy grass (*Stipa vaseyi*) is found in the southwestern part of the United States from western Texas to Arizona and as far north as Colorado. Although it is not important from the standpoint of stock losses, it perhaps should be mentioned because of the peculiar interest attached to its effect. It is shown in Plate 1 and is a tall, coarse grass which can be readily distinguished from the other grasses. In Lincoln and Otero Counties, N. Mex., in the general region of the Sacramento and Sierra Blanca Mountains, it has long

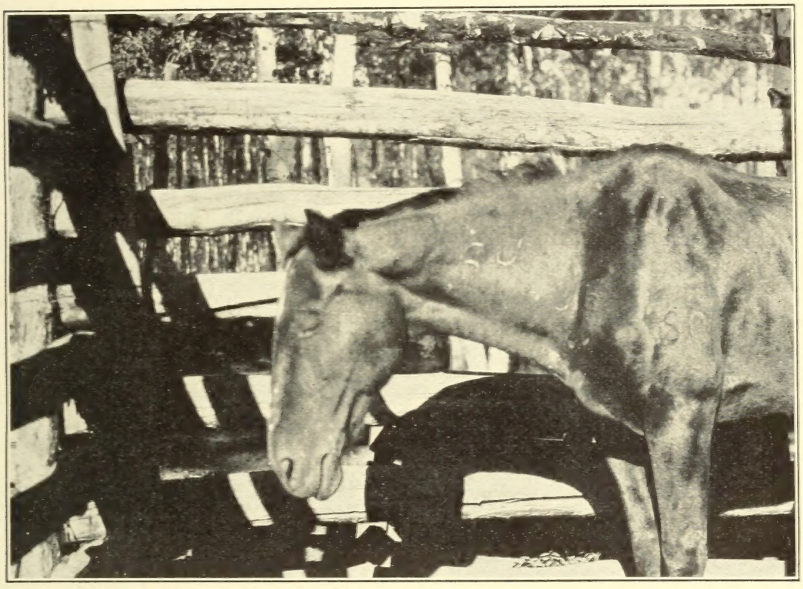


FIGURE 1.—A horse fast asleep after eating sleepy grass

been known to produce the peculiar, narcotic effect on horses which has given it its name. Horses go to sleep and may remain asleep for a day or more. Parties traveling with pack trains sometimes have their horses so affected that they are obliged to wait in camp for their recovery. Figure 1 shows a horse in a sound sleep. It is a curious fact that outside the region mentioned the plant is not known to be poisonous; feeding experiments with the plant in both green and dry stages from this locality have produced definite and pronounced effect, whereas the plant from other neighborhoods in New Mexico was nontoxic. The experiments indicate that cattle are not affected, and sheep only slightly, although there are reports of cattle losses. It seems probable that there are few if any actual losses from sleepy grass, so that it is of little importance to stockmen on the range.

ARROW GRASS (TRIGLOCHIN MARITIMA)

A cyanogenetic plant growing in wet places in saline or alkaline soil; it has caused many losses of cattle.

DEATH CAMAS (ZYGADENUS VENENOSUS)

The Meadow species of death camas growing most abundantly in the Pacific States

## THE ARROW-GRASS FAMILY (JUNCAGINACEAE)

### ARROW GRASS (TRIGLOCHIN MARITIMA)

Arrow grass is a grasslike plant growing usually in saline or alkaline soil, in marshes about lakes, and in seepage regions. The picture (pl. 2) shows its form. The long flower stem projecting beyond the leaves is noticeable and the leaves, while grasslike, are fleshy and half-round in section. It grows to a height of 2½ feet and sometimes covers large areas, and is found in all the northern continents and in northern Africa. In North America it occurs from Labrador to New Jersey and from Alaska to southern California and in wet areas across the continent. It sometimes grows in small patches near springs, but under favorable circumstances it may cover continuously many acres and frequently may compose a considerable proportion of hay cut in swampy regions. It has long been known to be one of the cyanogenetic plants, that is, one capable of producing the very poisonous hydrocyanic acid. Rather recently it has been found to cause considerable losses of livestock in the United States, particularly of cattle. As in the case of other cyanogenetic plants, toxic effects are produced when a considerable quantity is eaten in a comparatively short time. Small quantities of the plant may be eaten with no bad result.

After hay is cut, where there is much arrow grass, the second growth of the plant comes up more quickly than the grasses. When cattle are grazed in such pastures there have been some rather heavy losses.

There is no efficient remedy for poisoning by arrow grass, but if its poisonous character is recognized, losses can generally be avoided by suitable handling of livestock.

## THE LILY FAMILY (LILIACEAE)

### DEATH CAMAS (SPECIES OF ZYGADENUS)

The larger part of the losses of sheep from poisonous plants during the spring and early summer months is due to the various species of Zygadenus, or death camas.

Plate 3, a picture of *Zygadenus venenosus*, gives a clear idea of the general appearance of these plants. All the species have green, grasslike leaves, which, at the early stages of growth, are not readily distinguished from the grasses among which they may be growing. When in blossom, however, the yellowish-green or yellowish-white heads of flowers are rather conspicuous. Some of these plants grow in fairly dense masses, covering several acres. All grow from a bulb which, in most cases, is rather deeply buried, and is not likely to be pulled up by grazing animals.

A number of popular names have been applied to these plants, but death camas and poison sego are those most commonly used. In the Pacific States perhaps lobelia is used more than any other name. It would probably be well if there were a general adoption of the term "death camas."

The botanists recognize a number of species, but there are five with which the western stockman is most likely to come in contact.

### Grassy Death Camas (Zygadenus gramineus)

The grassy death camas, *Zygadenus gramineus*, is especially common in Montana, Wyoming, and the neighboring States, and is responsible for heavy losses in the spring. It starts before the grasses and matures in May and June. The plant and fruit are shown in Plate 4.

### Foothill Death Camas (Zygadenus paniculatus)

*Zygadenus paniculatus*, known as the foothill death camas, is the common species in the intermountain region. It has a compound flower stem, so that the group of flowers is more extended than in the other species. This species causes much sickness, but not so many deaths as does the grassy death camas.

### Meadow Death Camas (Zygadenus venenosus)

While the foothill death camas grows on gravelly ridges and dry areas, the meadow death camas (*Zygadenus venenosus*) (pl. 3), grows in damp meadows. It is the common death camas of the Pacific States and causes much trouble, though not so many deaths as the grassy death camas.

### Mountain Death Camas (Zygadenus elegans)

In gullies and damp places in the mountains above 8,000 feet there is found another death camas, *Zygadenus elegans*, sometimes in considerable masses. While this closely resembles the other species, it is only slightly poisonous and probably never injures animals on the range.

### Nuttall Death Camas (Zygadenus nuttallii)

It has recently been shown that a fifth species, Nuttall death camas, growing in Kansas, Oklahoma, and Texas, is also poisonous to livestock and is even more poisonous than the species growing in the Western States. The reported losses by this death camas have been of cattle, although the plant is equally poisonous to sheep.

### Death Camas Poisonous to All Animals

Cattle may be poisoned by death camas, and horses are frequently made sick by it. Most of the losses, however, are of sheep. There have been many serious cases of human poisoning when children or others have eaten the bulbs.

### Symptoms of Zygadenus Poisoning

The prominent symptoms of Zygadenus poisoning, as seen on the range, are frothing at the mouth, nausea with vomiting, great weakness accompanied sometimes with nervousness and resulting in collapse of the animal (fig. 2), which may lie without food for hours, or even days, before death terminates the case. It is not unusual for large numbers of sheep in a band to be poisoned by Zygadenus,

GRASSY DEATH CAMAS (ZYGADENUS GRAMINEUS)

This is the plant that causes especially heavy losses of sheep in Montana and Wyoming.

and in such cases the result is almost always heavy loss. (Fig. 3.) Perhaps more cases of Zygadenus poisoning have been reported from Montana than from any other State, but this is simply because the cases have been under observation in that locality; the losses are probably just as heavy in Utah, California, and elsewhere.

FIGURE 2.—A sheep very sick from eating foothill death camas. *Zygadenus paniculatus*

### TREATMENT FOR ZYGADENUS POISONING

There are no medicinal remedies which can be used effectively for Zygadenus poisoning. The important thing is to avoid the possibility of the sheep's eating any large quantity of the plant. Unfortunately, the plants are quite toxic, so that comparatively small quantities may produce harm.

## THE BEECH FAMILY (FAGACEAE)

### OAK (SPECIES OF QUERCUS)

Throughout the grazing regions of the West there is a very general belief in the poisoning properties of oak leaves, more particularly in regard to their supposed toxic properties for cattle. It is quite generally thought that poisonous effects are produced in the spring, when cattle are eating the buds and young leaves. This belief applies especially to the Gambel oak (*Quercus gambellii*), which is a common scrub oak of Colorado, Utah, and New Mexico, and to the shinnery oak (*Quercus havardi*), a low shrub in eastern New Mexico and western Texas. Extended experiments have been carried out on these plants by the United States Department of Agriculture.

FIGURE 3.—A locality in the State of Washington, where 900 sheep out of a flock of 1,900 were victims of grassy death camas

It has been found that when cattle eat very heavily of oak forage, especially in the spring, when the foliage is tender and attractive

and the grasses have not started, many animals contract so-called "oak-poisoning," showing constipation, black and bloody feces, emaciation, and surface swellings on the body. This condition is so serious as sometimes to cause a considerable number of fatalities. It is not true, however, that oak forage is necessarily harmful. In fact, on many ranges the oaks furnish a very important element in the feed of cattle, and animals generally come from oak ranges in the fall in fine condition. It has been clearly shown that an exclusive diet of oak is likely to result in some sick animals and consequent losses. If there is other forage with the oak, no bad results will follow. If cattle, in poor condition as the result of short feed in the winter, are turned upon an oak range where there is little grass, some losses are almost sure to follow. It pays to feed cattle in the winter so as to keep them in good condition, and then they are not likely to overeat when they come in contact with oak.

Plate 5 shows an overgrazed range in the oak belt of the Wasatch Mountains. It shows how cattle, when driven by lack of other feed, eat oak leaves and twigs as high as they can reach. Figure 4 shows a heifer poisoned by the common scrub oak of Utah, and Figure 5 a "shinneried" bull on the plains of western Texas.

## THE GOOSEFOOT FAMILY (CHENOPODIACEAE)

### GREASEWOOD (SARCOBATUS VERMICULATUS)

Greasewood (*Sarcobatus vermiculatus*) is a well-known plant common on the alkaline plains of the West. It is a spiny shrub growing from 3 to 9 feet in height, with narrow, fleshy leaves not exceeding about 1½ inches in length. In Figure 6 is shown a plant, and in Plate 6 are shown branches with leaves and staminate flowers.

While greasewood is grazed by sheep on the winter range with no bad effects (as a matter of fact the plant forms an important element in the winter forage), there have been, under some conditions, severe losses of sheep. If very hungry animals eat a large quantity in a short time, fatal results may follow. Cases are known in which several hundred were lost.

Figure 7 shows a sheep which was killed by an extract of greasewood. The picture was taken shortly before its death. The poisonous effects are produced by the sodium and potassium oxalates in the plant.

## THE CROWFOOT FAMILY (RANUNCULACEAE)

### LARKSPURS (SPECIES OF DELPHINIUM)

A great many species of larkspurs grow in the western stock ranges, and they are widely distributed throughout the mountain regions which are used for pasturage. These plants when in blossom are very easily recognized by the peculiar form of the flower. Before blossoming there are a few plants with which they may be confused by a person not versed in botany, but it is not particularly difficult for the ordinary observer, after a little experience, to recognize larkspurs in all stages of growth. While there is a large number of

AN OVERGRAZED OAK-BRUSH RANGE

This shows how cattle, when other forage is scanty, "trim up" the oaks.

species, all may be grouped under the two general heads of tall larkspurs and low larkspurs.

### Tall Larkspurs

The tall larkspurs in their maturity reach a height of 4 or even 6 or 8 feet. They are perennials and grow in great abundance in the high mountain regions, ordinarily preferring damp and sheltered places, such as are found in mountain valleys and under trees. Under some circumstances, however, they may grow in considerable abundance in the open. All the tall larkspurs agree in the form of the leaf, which is well illustrated in Plate 7 and Figure 8. The flowers, with the spur from which the plant gets its name, are very characteristic in their form and in most species vary in their colors through various shades of violet, blue, and purple. Before the plants are mature the leaves may be confused with those of the wild geranium, which in many places grows abundantly with the tall larkspur, but the different habit of the plant makes it comparatively easy to distinguish between them.

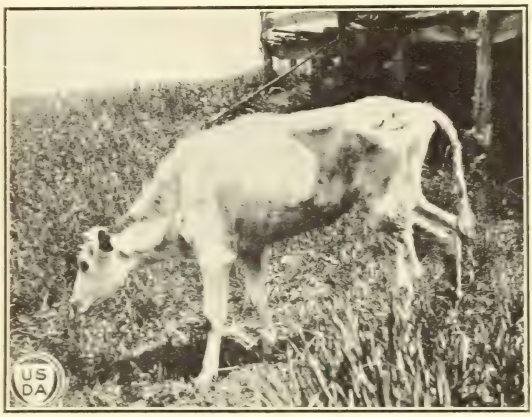


FIGURE 4.—A heifer suffering from poisoning by the scrub oak of Utah

FIGURE 5.—A "shinnered" bull in western Texas

It is more difficult to distinguish between monkshood and larkspur, because the leaves of the monkshood are almost identical in form with those of the larkspur, and the habit of the plant is similar. The leaves of monkshood have shorter petioles (leaf stalks) than those of larkspur.

Species of tall larkspurs are found in all the mountain ranges of the West at high elevations, growing up as high as the timber line. Sometimes they are found as scattered clumps of plants, but frequently they grow in large masses.

Plate 7 shows the leaf, flower, and seed pod of the dunce-cap larkspur which is most common in Montana and adjoining States, known to botanists as *Delphinium cucullatum*. This does not ordinarily

grow to any considerable height—perhaps not more than 4 feet—and the flower is less conspicuous than in most of the tall larkspurs. The color is ordinarily described as a grayish purple, due to the fact that there is considerable white in connection with the violet-purple shades of the corolla. This plant is responsible for most of the deaths of cattle by larkspur in Montana. Plate 8 shows the tall larkspur of the Pacific coast region, thin-leaf larkspur, *D. trolliifolium;* it has a much more conspicuous and beautiful flower than *D. cucullatum.*

FIGURE 6.—Greasewood. *Sarcobatus vermiculatus*, plants on the range

Barbey larkspur, *Delphinium barbeyi*, is perhaps the most widely distributed species of the tall larkspurs and is the plant which causes the greater part of the tall-larkspur losses in Colorado, Utah, and some other localities. Figure 8 shows the leaves and blossoms of this species, and Figure 9 a group of the plants in blossom.

In most cases the tall larkspurs blossom during the summer months and do not die down until they are broken by the snows of the early fall. The exact time of blossoming differs with the species and with the places in which they occur. In the mountains of Colorado the blossoming period is ordinarily in July, and the seeds are formed in August, after which the plant commences to dry up. The leaves of the tall larkspurs lose their poisonous properties after blossoming, so that in most localities the cases of poisoning from these plants occur in the spring or early summer. In the case of some species, however, especially in localities where the snowfall is heavy and remains late in the

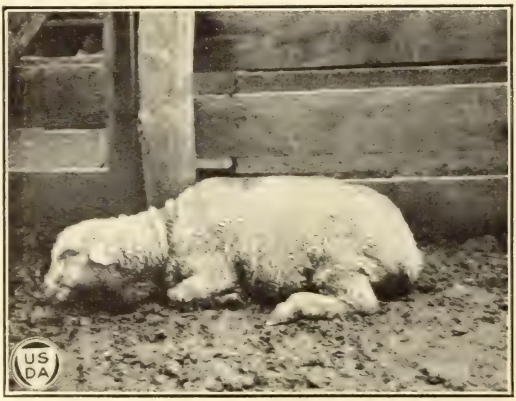


FIGURE 7.—A sheep which was killed by extract of greasewood

GREASEWOOD (SARCOBATUS VERMICULATUS)

Branches showing leaves and staminate flowers.

season, as in certain parts of the Sierras, the period of blossoming continues late into the summer, so that poisoning cases may occur at any time during the season.

The seeds of the tall larkspurs are very poisonous, but they are not eaten to any extent by cattle.

### Monkshood (Aconitum columbianum)

Plate 9 is a picture of the ordinary monkshood or aconite and is inserted in order that it may be compared with the pictures of the larkspur, and the similarity noted. Monkshood, as is well known, is a poisonous plant, but somewhat extensive experimental work by the Department of Agriculture has demonstrated that it does not poison livestock on the range. It is important, therefore, that this plant should be distinguished from larkspur, because in some localities it occurs in great abundance, while larkspur is comparatively rare. This is true of certain parts of the Yellowstone Park, where in some localities the swampy regions are blue with monkshood in the summer months, while the larkspur is only rarely met with. In other parts, however, like the region between the Yellowstone Lake and the Grand Canyon, the larkspur is very abundant and the monkshood comparatively rare.

Figure 8.—Barbey larkspur, *Delphinium barbeyi*, leaves and flowers

Flowers of the monkshood have the peculiar form from which the plant has received its name, and in most regions they are much darker in color than the larkspurs. Generally speaking, in the monkshoods of the West the flowers are of a very deep blue. There are localities, however, in which the shades of color are much lighter, almost the exact shades of the violet and purple that are more typical of the larkspurs, while in other places the flowers are almost white.

The roots of the tall larkspur are long, tough, and fibrous, while the roots of monkshood are short and tuberlike, with golden-yellow rootlets. The stem of the tall larkspur is hollow, whereas the stem of the monkshood is pithy.

### Low Larkspur

Plate 10 is a typical picture of the low larkspur which is most widely spread throughout the western ranges. This species is *Delphinium menziesii*, probably the most destructive of the low lark-

DUNCE-CAP LARKSPUR (DELPHINIUM CUCULLATUM)

This is the tall larkspur which is abundant in Montana and adjoining States. It differs from the other tall larkspurs in the smaller size and less conspicuous coloring of the flowers

THIN-LEAF LARKSPUR (DELPHINIUM TROLLIIFOLIUM)

This is one of the tall larkspurs of the Northwest, and is conspicuous because of its large and beautiful flowers

COLUMBIA MONKSHOOD (ACONITUM COLUMBIANUM)

The monkshoods grow in close proximity to the tall larkspurs, and are frequently confused with them. The leaves are almost identical in form, and the plants grow to the same height. They can, however, be distinguished by the form and color of the flowers. Although poisonous plants, the monkshoods do not poison cattle

SPRING LARKSPUR (DELPHINIUM MENZIESII)

This is the most common of the low larkspurs, extending from Colorado to the Sierras, and causes heavy losses of cattle

spurs, owing to the fact that it occurs in such enormous masses. There are regions in Colorado and Utah where many acres are almost carpeted with these plants. They occur early in the spring, immediately after the snow disappears, growing more rapidly than the grasses, so that in some regions they seem for the time almost to preempt the soil. These low larkspurs blossom comparatively early in the season, and in Colorado *D. menziesii* dries up and disappears not far from the first of July. Consequently the cases of poisoning from low larkspurs occur almost entirely in May and June.

It will be noted that the leaves of the low larkspurs are quite different from those of the tall larkspurs, but are easily recognized after one becomes fairly familiar with them.

FIGURE 9.—A group of plants of the tall larkspur, *Delphinium barbeyi*, growing in natural surroundings. The white background brings out the plants more clearly. This species is the most widely distributed of the tall larkspurs and is responsible for greater losses of cattle than any other species. It extends from Colorado to the Sierras

There is another low larkspur, *Delphinium bicolor*, occurring commonly in Montana, which is typical of somewhat lower altitudes than *D. menziesii* and apparently never grows in sufficiently large masses to be dangerous. One of the low larkspurs, the Anderson larkspur, *D. andersonii*, growing in Nevada, California, and Oregon, causes many fatalities.

The low larkspurs are poisonous throughout the whole period of their lives, while the tall larkspurs gradually lose their poisonous properties after blossoming.

In Plate 11 is shown the Plains larkspur, *D. virescens*, which has white blossoms. This is common in the Plains region east of the Rocky Mountains; it probably occurs rarely in sufficient abundance to cause harm, but there is reason to think that in some seasons it has occasioned the death of a considerable number of cattle.

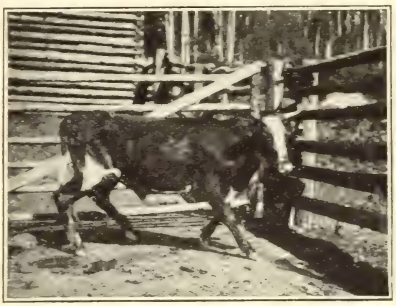
PLAINS LARKSPUR (DELPHINIUM VIRESCENS)

The white larkspur of the Plains, which is found as far south as Texas. It is probably responsible for occasional losses of cattle.

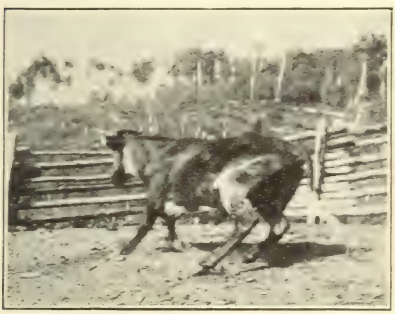
### Parts of Larkspurs Poisonous

There is a general belief throughout the West that it is the roots of the larkspur which are particularly poisonous. Experiments have proved conclusively, however, that the different parts of the

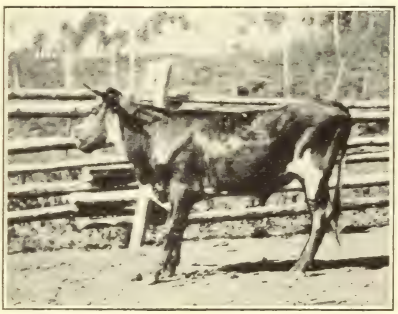
*A.*—Hind legs braced apart in the effort to remain standing



*B.*—Staggering



*C.*—Remaining on feet with great difficulty



*D.*—Backing in the manner characteristic of larkspur poisoning

*E.*—Just before falling

*F.*—Falling in the manner typical of larkspur poisoning

FIGURE 10.—Characteristic attitudes of a steer severely poisoned by larkspur

plant are equally poisonous, with the exception that the seeds are especially so. Probably in almost all cases of larkspur poisoning the trouble is caused by eating the leaves, sometimes with the flowers.

As was said before, most of the cases of larkspur poisoning occur in the spring or early summer.

### Animals Poisoned by the Larkspurs

While horses can be poisoned by corral feeding of larkspurs, there is reason to think that if left to themselves upon the range they never eat enough of these plants to do any harm. Sheep eat the larkspurs freely without suffering any evil consequences. There is a rather general belief in many regions of the West that losses of sheep have been caused by larkspur feeding, but many experiments on a large number of species, and in different regions, have proved conclusively that sheep can be grazed on larkspur without any risk whatever. In fact, it may almost be said that larkspur furnishes good forage for sheep. The losses from larkspur poisoning, then, are altogether with cattle, and these losses are very heavy.

### Symptoms of Larkspur Poisoning

While the result of corral feeding shows that there are a number of preliminary symptoms, as animals are noticed on the range the first symptom commonly observed is the sudden falling of the animal accompanied by violent struggles. The animal is unable to rise, but after a few moments may get upon its feet and walk away, and show no further symptoms. In more acute cases of poisoning the first fall will be followed by a second, and that possibly by a succession of falls, which in severe cases of poisoning are followed by complete prostration, vomiting, and death. Figure 10 shows some of the attitudes assumed by a severely poisoned animal.

### Treatment of Cattle Poisoned By Larkspur

Inasmuch as death from larkspur poisoning is caused by respiratory paralysis, it is very important, if the animal is found poisoned by this plant, that immediate means shall be taken to relieve the difficulty in respiration. In their struggles animals poisoned by larskpur ordinarily throw themselves with their heads downhill, and in this position the stomach and intestines press on the lungs and seriously interfere with the function of respiration. If while in this position the animal should vomit, some of the regurgitated material is very apt to fall back into the windpipe and cause asphyxiation. When, therefore, an animal is seen to fall from larkspur poisoning, it should be turned about with its head uphill and erect and should then be left undisturbed. It is also desirable under such conditions to give the physostigmine remedy hypodermically, as recommended in Farmers' Bulletin 988.[3] The remedy has the following formula:

| | |
|---|---|
| Physostigmine salicylate | 1 grain. |
| Pilocarpine hydrochloride | 2 grains. |
| Strychnine sulphate | ½ grain. |

[3] Marsh, C. D., Clawson, A. B., and Marsh, H. Larkspur or "poison weed." U. S. Dept. Agr. Farmers' Bul. 988, 15 p., illus. 1918. (Revised ed.)

CHOKECHERRY (PRUNUS DEMISSA)

Chokecherries grow in great abundance on the stock ranges of the mountain regions and sometimes occasion heavy losses

This formula would apply to an animal weighing 500 or 600 pounds. For a large steer or cow of 1,000 pounds or more the dose should be twice that given in the formula. These materials can be obtained from any dealer in drugs. The physostigmine salicylate and pilocarpine hydrochloride are furnished in veterinary hypodermic tablets, each containing one-half grain of physostigmine salicylate and 1 grain of pilocarpine hydrochloride. The strychnine sulphate can be obtained in tablets each containing one-half grain. These dissolve easily, and it is well to have two or three doses ready in small, homeopathic bottles. For yearlings one should use two of the physostigmine-pilocarpine tablets and one of the half-grain strychnine tablets dissolved in an 8-dram homeopathic bottle one-third full of water; for full-grown cattle four of the physostigmine-pilocarpine tablets and two of the strychnine tablets dissolved in an 8-dram bottle two-thirds full of water should be used.

It is best to use an all-metal hypodermic syringe. This can be easily cleaned by boiling. The form which has been found most useful for the field is that known as the Quitman syringe. In this the needles are carried in the hollow piston, and a case is therefore unnecessary. The syringe should be of the 10-centimeter size, which holds one-third of an 8-dram bottle of water, so that the remedy can be given to yearlings in a single dose, while for mature cattle the syringe must be filled twice. The needle is most conveniently inserted in the shoulder. There is little doubt that prompt treatment of animals poisoned by larkspur will result in the saving of most of the cases.

## THE ROSE FAMILY (ROSACEAE)

### CHOKECHERRY (SPECIES OF PRUNUS)

For years there have been persistent reports of poisoning, especially of sheep, from eating chokecherry leaves. There has been great difficulty in proving the truth of these stories, for it has frequently happened that of several bands going through a mass of wild cherry, possibly only one would suffer, while the others would go through with no cases of poisoning. A large number of experiments, many of which have been without results, have been performed with chokecherry leaves. Investigations by the department, however, have verified the statement that the leaves may be extremely poisonous, and there seems to be no doubt that, under certain circumstances, animals may be killed by eating this plant. These cases ordinarily occur along drives that are bordered by chokecherry and where there is very little else for the animals to eat.

It has been found that the rather widespread idea that cherry leaves are specially dangerous when wilted is erroneous.

Sheepmen should by all means avoid, if possible, trails that are lined with chokecherry, and if it is necessary to drive over these trails, they should be sure that the animals are well supplied with food before commencing the drive. Poisoning from chokecherry is due to prussic acid, and death results very quickly. (Figs. 11 and 12.) No treatment is likely to modify the results.

Plate 12 shows the chokecherry of the West.

## THE PULSE FAMILY (FABACEAE)

### LUPINES (SPECIES OF LUPINUS)

The lupines are among the most conspicuous of the flowering plants upon mountain ranges. They are scattered in a very large number of species over practically all the grazing regions. They are known under a great variety of common names, among which are "blue pea" and "wild bean."

FIGURE 11.—Sheep poisoned by cherry, gasping for breath

The picture of the silky lupine, *Lupinus sericeus* (pl. 13) will serve for the identification of any of the lupines. The form of the leaf and the color of the flower, ordinarily shades of purple or blue, readily distinguish this plant from others growing in the same neighborhood. The seeds are especially poisonous, and most cases of poisoning result from eating the pods containing seeds. The pods alone, however, may poison, and sometimes sheep are poisoned by the leaves, or by the leaves in combination with the seed pods.

The losses from lupine poisoning are mostly of sheep, although some horses are poisoned. Some of the lupines growing in California are known to be distinctly poisonous to cattle. It is probable that the lupines are the principal cause of sheep losses in the late summer and fall months. It is not by any means to be understood that sheep are always poisoned when they come upon a patch of lupine, for bands of sheep may feed through lupine for a whole season without any harm. When, however, a hungry band comes upon a patch of lupine at the time when the pods are filled with seeds, poisoning frequently occurs. Cases of poisoning sometimes happen when sheep are taken from the cars and allowed to graze freely on lupine. Many

FIGURE 12.—Sheep in the last stages of chokecherry poisoning

SILKY LUPINE (LUPINUS SERICEUS)

Many of the species of lupine are poisonous, and are the cause of the larger part of the heavy losses of sheep during the late summer and fall months Sheep are poisoned by eating the pods and seeds

cases of poisoning have occurred when the sheep are brought down from the mountains in the fall. If during that passage the band is overtaken by a snowstorm, sometimes it will feed freely on the lupine pods which remain above the snow, and heavy losses may occur. It is not unusual for several hundred of a band to be killed by lupine poisoning. These losses are not confined to any one State, but occur in most of the Western States where sheep are grazed on the range. While there is definite experimental proof of the poisonous properties of some of the lupines, others are known to be not poisonous. It is difficult, however, even for one trained in botany, to distinguish between these, so that the wise herder will endeavor to keep his sheep away from all lupines when the plants are in pod.

FIGURE 13.—A range sheep poisoned by lupine

#### SYMPTOMS OF LUPINE POISONING

The symptoms of lupine poisoning in sheep resemble in many respects those produced by some other poisonous plants. There is frothing at the mouth, but in addition the animals run about in a frenzy, butting against any opposing object in a way which seems to be characteristic of this disease. Figure 13 shows a range sheep poisoned by lupine. This was one of a large number affected as they were coming from summer range. In Figure 14 is shown a poisoned sheep butting against the side of the pen. This is typical of lupine poisoning.

#### TREATMENT OF LUPINE POISONING

No medicinal remedies have been found for cases of lupine poisoning. The only thing for a sheep herder to do is to make certain in advance that the animals under his care shall not come upon a patch of lupine in pod when they are particularly hungry.

### POISON BEAN (DAUBENTONIA DRUMMONDII)

The poison bean, *Daubentonia drummondii*, frequently called coffee bean, (pl. 14) is a shrub growing in the Gulf region and extending as far north as the northwestern border of Texas. It likes to live with "its feet in the water" and is found in great profusion along ditches and sluggish streams in southern Texas.

The leaves are alternate, with 12 to 60 leaflets, and the flowers are lemon yellow. The pods, as shown in the illustration, have four wings and the seeds are separated from one another by cross partitions in the pods.

So far as known, the green plant does no harm. The seeds are poisonous and a sheep may be poisoned by a little more than an ounce or killed by something less than 2 ounces. The pods have

little if any poison. Cases of poisoning occur in the winter on areas where feed is scanty.

All the known cases of poisoning have been of sheep and goats. Animals eating the seed show depression, generally accompanied with diarrhea. In fatal cases the symptoms are not especially pronounced; but the animals become weak, have labored breathing, and die with very little struggling. Considerable time elapses between the feeding and the appearance of symptoms, sometimes as much as 24 hours. The symptoms, too, may continue several days, so that poisoned animals require special care until after complete recovery. Figure 15 shows a sheep poisoned by the poison bean.

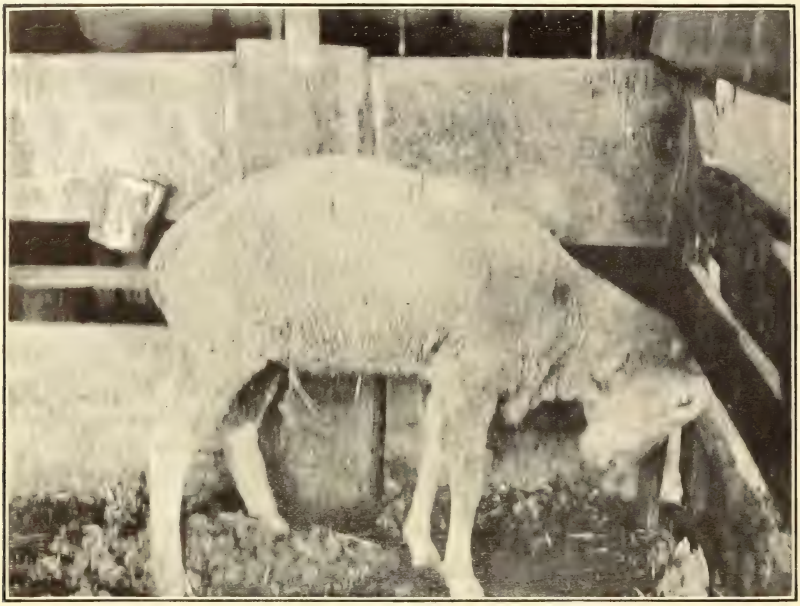


FIGURE 14.—A sheep poisoned by lupine in the typical attitude of butting against some object

### LOCO WEEDS (SPECIES OF OXYTROPIS AND ASTRAGALUS)

Without any doubt the most destructive of all the poisonous plants are those going under the general name of loco. That extensive losses of domestic animals have been caused by loco plants has been believed for a long time, but it is only within the last few years that exact evidence, by careful experiments, has shown definitely that these plants produce the effect which has been popularly ascribed to them. A great deal of interest attaches to these plants because of their wide distribution and the large number of animals that have been poisoned by them, including cattle, horses, goats, and sheep, and also because of the difficulty of actually proving the existence of a poisonous principle in the plants themselves.

The loco weeds have had a place in romantic literature, as it has frequently been asserted that they produce the same effect on human

POISON BEAN (DAUBENTONIA DRUMMONDII)

The seeds have caused losses of sheep and goats.

beings as upon the lower animals, and it has been a popular subject for the short-story writer. None of these stories of "locoed" men, however, have any substantial foundation.

The word loco is from the Spanish, meaning crazy, and was given because of the supposed effect upon its victims. Loco weeds have been heard of in practically all the open-range country of the West, except in the higher mountains, and there is no doubt that under the term loco disease a large number of ailments have been included. Experimental proof, however, has shown that there is a disease occasioned by these plants, with distinct symptoms and with a definite outcome.

The early writers on the subject of loco spoke of "the" loco plant. It is now known that the typical symptoms of loco poisoning are produced by several plants. Six have been shown to be true loco weeds and there may be others, while some other closely related plants are poisonous to livestock but should not be classed as locoes. It is desirable that the term "loco" should be confined to those plants which cause typical loco symptoms.

Three of the true loco weeds are especially destructive, the white loco, the purple loco, and the blue loco.

### White Loco (Oxytropis lambertii)

Of all the loco weeds, the most destructive is the white loco weed, or rattleweed, *Oxytropis lambertii* of the botanists. This is not because of its greater toxicity, but because it grows in great abundance over a wide territory and is poisonous not only to cattle, goats, and sheep but to horses. It is found in the Plains region east of the Rocky Mountains from northern Canada to central Texas. Like all the loco weeds, it belongs to the Fabaceæ or pea family, the family in which are found peas, beans, clovers, alfalfas, etc. It is a stemless, perennial plant, living two or three years or more, and has a long root system which enables it to withstand conditions of drought. The leaflets of the compound leaves are slender, more or less hairy, and of an olive-green color. Thrifty plants are a foot or more in height.

FIGURE 15.—A sheep poisoned by poison bean, *Daubentonia drummondii*

The spikes of flowers are borne on stems extending above the leaves and are commonly of a prevailing white color, hence its name of white loco. The corolla, however, is frequently streaked with purple; sometimes the calyx is red; and sometimes, particularly in

WHITE LOCO WEED (OXYTROPIS LAMBERTII)

This is the most destructive of all the loco weeds, not because of its greater toxicity but because of its wide distribution, extending from northern Canada to central Texas, and from the Continental Divide to the western part of Minnesota. It poisons horses, cattle, and sheep

FIELD OF WHITE LOCO WEED (OXYTROPIS LAMBERTII)

This landscape, in Montana, is a typical one, and shows with what great abundance this plant grows under favorable circumstances. It grows in equal abundance in Wyoming and Colorado

PURPLE LOCO WEED (ASTRAGALUS MOLLISSIMUS)

This plant is sometimes known as the true loco, and grows abundantly in Texas and New Mexico. It seldom injures any animals except horses, but is very poisonous to them

mountain regions, the whole corolla may be of a deep violet or purple color. All gradations in color may be found between these extremes. When the plants are in fruit the pods rattle as one hits them in walking, very closely imitating the rattle of a rattlesnake, hence the name rattleweed.

Plate 15 is a picture of the white loco weed as found in the plains of Colorado. Plate 16 shows a field of the plant in blossom. The latter picture was taken in the Yellowstone Valley of Montana, but it could easily be duplicated in Wyoming or Colorado.

It is evident that where the plant occurs in these great numbers such a thing as eradication is impossible except by plowing over the whole area. If animals are turned loose in such a region as this they certainly will have an opportunity to obtain an abundance of loco.

### Purple Loco Weed (Astragalus mollissimus)

*Astragalus mollissimus*, popularly known as purple loco, woolly loco, and sometimes as Texas loco, is a plant that has been historically known as the true loco. It is probably the first plant which was recognized as a loco dangerous to livestock. It does not grow north of Nebraska, and perhaps is most abundant in the Panhandle of Texas, although it is found in adjoining regions of New Mexico, Colorado, Kansas, and in Nebraska. The leaflets are very hairy and are much broader than those of the white loco. The plant also has a true stem, while the white loco has sometimes been known as the "stemless loco."

Plate 17 shows a very small plant of this loco. The flowers are not so conspicuous as in the white loco weed, and the corolla is of a deep-purple color. The pods are shorter, thicker, and of a deep-brown color. Large plants of purple loco may under favorable circumstances be about a foot in height and perhaps 2 feet in diameter. It does not commonly grow in the great abundance characteristic of the white loco, but there are sometimes fairly extensive fields. Where it grows in connection with the white loco weed the purple loco weed is more inclined to grow in depressions, while the white loco weed is found more abundantly at slightly higher levels. Purple loco weed is particularly destructive to horses; cattle may be poisoned by it, too, although this is rarely the case, perhaps because cattle do not eat it very readily.

### Blue Loco Weed (Astragalus diphysus)

Plate 18 is a picture of *Astragalus diphysus*, known as blue loco. These plants differ in their appearance very markedly from the white and purple locoes. The leaflets are small and of a deep-green color, like alfalfa. This is perhaps the most common loco weed of western New Mexico and Arizona, and extends westward into Nevada. It appears in January or February and dries up in the summer. It sometimes forms a considerable portion of the vegetation. Figure 16, a picture taken in northern Arizona in April, gives an idea of the size of the plant and of the luxuriance of its growth. It is still poisonous after drying, and considerable losses are said to have occurred in Nevada from the dry plant.

BLUE LOCO WEED (ASTRAGALUS DIPHYSUS)

This is a type of a number of loco plants growing in the Southwest, which are particularly destructive to horses. Experimental work has proved that this plant poisons both horses and cattle.

In past years the blue loco weed has been known mainly as a horse-poisoning plant and has been responsible for heavy losses in Arizona. However, it will affect also cattle and sheep, and recently has caused much trouble with cattle.

### Wooton Loco Weed (Astragalus wootoni)

Growing in western Texas, New Mexico, eastern Arizona, and northern Mexico, Wooton loco weed resembles the true blue loco so closely that frequently they are not distinguished from each other. This loco weed, however, has larger inflated pods, and its leaflets are somewhat narrower. It is considered especially poisonous to horses, but it has been shown to affect cattle and sheep also. It is one of the more poisonous locoes.

Figure 16.—Blue loco weed growing in Arizona in April

Half-moon loco weed, *A. allochrous*, shown in Plate 19, grows in the same general localities, but on sandy soils. This is so much like the Wooton loco weed that some botanists have not considered them as separate species.

### Sheep Loco Weed (Astragalus nothoxys)

Sheep loco (pl. 20), is a low, spreading plant which grows in considerable abundance in southeastern Arizona and adjoining New Mexico and Mexico. Single plants may be 2 feet in diameter. The flowers are white-tipped or spotted with violet. The narrow pods are about 1 inch in length. Experimental work with sheep and cattle has shown that it is about as poisonous as the blue loco weed. Although it is commonly known as the sheep loco weed, the main losses have been of cattle.

HALF-MOON LOCO WEED (ASTRAGALUS ALLOCHROUS)

This plant is especially dangerous to horses in New Mexico and Arizona.

SHEEP LOCO WEED (ASTRAGALUS NOTHOXYS)

Low, spreading loco common in southern Arizona.

#### Thurber Loco Weed (Astragalus thurberi)

Thurber loco weed (pl. 21) has a range similar to that of the sheep loco, resembles Wooton loco weed, and sometimes is found in the same places. It can be distinguished from Wooton loco weed by the rather small, round pods, resembling large peas. As the pods grow on long stems, they are rather conspicuous. It is thought that this plant affects horses more especially, but it is known to be poisonous to cattle and probably is toxic to sheep. Its toxicity is about the same as that of Wooton loco weed.

#### Two-Groove Loco Weed (Astragalus bisulcatus)

Two-groove loco weed (pl. 22) is found from Alberta, Saskatchewan, and Manitoba as far as New Mexico and Oklahoma. It is a tall, coarse plant with an offensive odor. The flowers are purple, and the pods are two grooved. This plant has been said to produce loco symptoms in cattle in Wyoming and also to be poisonous to sheep. While there are very few experimental data, it is possible that it may be added to the list of loco plants.

### Species of Astragalus poisonous but not true locoes

Three species of supposed loco plants have been shown to be poisonous to livestock, but do not produce true loco symptoms. These are called poison vetches.

#### Palliser Poison Vetch (Astragalus palliseri)

Palliser poison vetch, *Astragalus palliseri* (pl. 23), known in Canada as timber loco, extends from Canada a short distance into the northwestern United States. Its stems are about 1 foot in height; its flowers are purple and its pods narrow, about one-half inch long and circular in section. It has been shown in Canada to be poisonous to all classes of livestock, but especially so to females in milk. The symptoms are not at all like those caused by locoes. No cases have been reported in the United States.

#### Four-wing Poison Vetch (Astragalus tetrapterus)

Four-wing poison vetch (*Astragalus tetrapterus*) has been found only in Utah and Nevada. There it has caused losses of cattle and sheep and is suspected of poisoning horses, but none of these animals show true loco symptoms. It has white or light purple flowers and is readily distinguished by the pods (pl. 24) from other Astragali. The pods are curved, woody, and have four pronounced wings.

#### Straight-stem Poison Vetch (Astragalus sabulosus)

Straight-stem poison vetch, *A. sabulosus*, sometimes known as *A. praelongus*, is a large, smooth, erect plant found from southwestern Colorado to Nevada, and south to central Arizona and New Mexico. It is shown in Plate 25 and has yellowish flowers in thick clusters; the pods are woody, oval, short-pointed, single-celled, and an inch long. It is most readily recognized by the character of the pods. Reports of poisoning by this plant have come from Magdalena, N. Mex.

THURBER LOCO WEED (ASTRAGALUS THURBERI)

This plant grows in the same region as the sheep loco weed, and is especially poisonous to horses.

TWO-GROOVE LOCO WEED (ASTRAGALUS BISULCATUS)

The plate shows leaves, flowers, and pods. The plant is said to produce loco symptoms.

PALLISER POISON VETCH (ASTRAGALUS PALLISERI)
In Canada this plant is reputed to be poisonous.

FOUR-WING POISON VETCH (ASTRAGALUS TETRAPTERUS)

It is readily recognized by the form of the pods; it is poisonous but does not produce loco symptoms.

STRAIGHT-STEM POISON VETCH (ASTRAGALUS SABULOSUS)

It has poisoned livestock in New Mexico without loco symptoms.

Experiments on sheep with the plant gathered in Utah produced acute cases of poisoning but without loco symptoms.

### NONTOXIC PLANTS SUSPECTED OF BEING LOCOES

Four plants popularly thought to be locoes have been shown to be harmless. These plants, *Oxytropis besseyi*, *Astragalus drummondii*, *A. striatus*, and *A. bigelovii*, are briefly described, with illustrations.

#### Red Point Milk Vetch (Oxytropis besseyi)

Plate 26 shows a picture of *Oxytropis besseyi*. This is a leguminous plant, rather common in the Yellowstone Valley, which is very closely allied to the white loco weed and is frequently mistaken for it. The flowers are of a deep-pink color, and the plant, while it grows in the same regions as the white loco weed, is found upon the arid barren summits of hills, the white loco growing most abundantly at slightly lower levels. The two plants intermingle to some extent, but after a little experience one is able to distinguish between them, as there are certain noticeable differences in the leaves. *Oxytropis besseyi* is known in Montana sometimes as the red loco, because of the color of the flowers. Although the plant is closely related to the white loco and grows in the same regions, there is abundant experimental evidence that it is harmless. It should not be considered as a loco plant.

#### Drummond Milk Vetch (Astragalus drummondii)

In Plate 27 is given a picture of *Astragalus drummondii*, which occurs in many regions in connection with the white loco weed and is frequently considered a loco plant. The plant is readily recognized by its coarse stems and yellowish flowers, both the flowers and pods being somewhat dependent. Many people consider this a dangerous plant, but many experiments by the Department of Agriculture have shown that it is entirely harmless and need not be feared. In general appearance *A. drummondii* resembles the two-groove poison vetch but is readily distinguished by the color of the flowers and by the pods, which are one grooved instead of two grooved.

#### Clover Milk Vetch (Astragalus striatus)

*Astragalus striatus* (pl. 28), in former publications called *A. nitidus*, is widely distributed and is abundant in the foothill region of the eastern slope of the Rocky Mountains, frequently growing with the white loco weed. Its leaves are deep green and its flowers purplish and in compact heads like clover. It has been called a loco, but has been shown to be harmless.

#### Bigelow Milk Vetch (Astragalus bigelovii)

Bigelow milk vetch (pl. 29) has long been considered one of the important loco plants of the Southwest. It is found from southwestern Texas to Arizona and in Mexico. It resembles the purple loco weed but is a larger and coarser plant, with more conspicuous flowers and with densely woolly pods, while the pods of the purple loco weed are smooth and dark brown or black. Because of this resemblance to the purple loco it is sometimes called the Texas loco or woolly loco. Experimental feedings indicate that the plant should not be classed as a

RED-POINT VETCH (OXYTROPIS BESSEYI)

This plant, closely resembling the white loco weed, grows in the same regions especially in Montana and Wyoming, in close proximity to the white loco weed, and is frequently considered a loco plant. Experimental work has proved that it is harmless. It can be distinguished from the white loco weed by the dark color of the flowers, and by the fact that it is more likely to grow on the dry summits of the hills, in more sterile locations than those in which the white loco weed is found

DRUMMOND MILK VETCH (ASTRAGALUS DRUMMONDII)

This plant is widely distributed in regions where the true loco weeds are found, and has been erroneously thought to be poisonous.

CLOVER MILK VETCH (ASTRAGALUS STRIATUS)

This plant is frequently, in foothill regions, found with the white loco weed, from which it can be distinguished by the deep color of the leaves and the thick heads of flowers. It is not poisonous.

BIGELOW MILK VETCH (ASTRAGALUS BIGELOVII)

A large, coarse plant resembling the purple loco weed. It has long been considered a loco plant, but experimental feedings indicate that it is not poisonous.

loco weed, as large quantities of dried plant have been fed without injuring the animals in any way.

### Symptoms of Loco Poisoning

All the loco plants produce similar effects. These symptoms appear only after a somewhat prolonged feeding, and this fact has led to the failure of a great many feeding experiments with loco. Ordinarily the first symptom in a locoed animal is a loss of condition. This is followed by irregularities of gait and weakness, which condition in many cases seems almost to amount to paralysis. The animal shows a lack of coordination in its muscular movements, due without doubt to the effect of the plant on the central nervous system. Horses formerly gentle become uncontrollable and shy violently at imaginary objects or leap high over some slight obstruction. Generally speaking, a locoed horse can be neither led nor backed, and when put in motion can not easily be stopped or turned, but may continue until it runs against a fence or other obstruction.

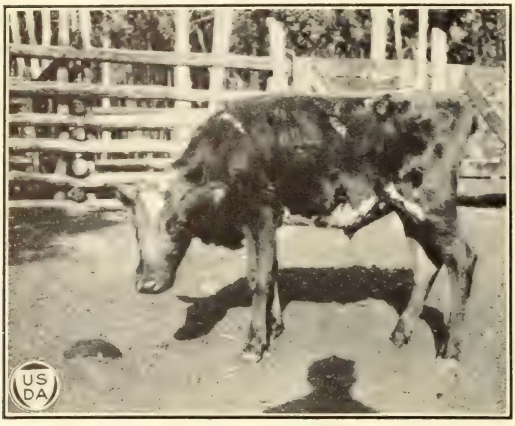


FIGURE 17.—A steer poisoned by the blue loco weed, *Astragalus diphysus*

Many animals acquire a liking for the plants to such an extent that they will eat nothing else. This, however, is not true in all cases. The animal, when affected, shows progressive emaciation and eventually starves to death. It is not at all unusual in a country where there are locoed cattle to see a steer standing by itself, sometimes remaining in one position for hours, or even for days, and finally falling and dying without making any attempt to go elsewhere for either feed or water.

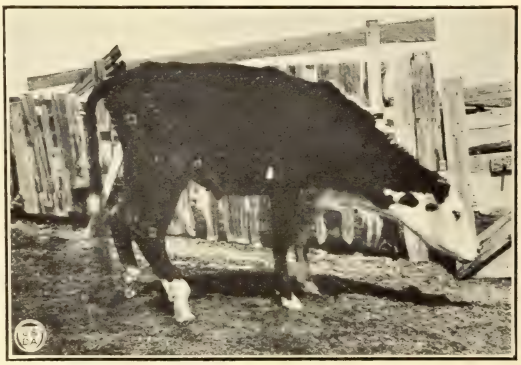


FIGURE 18.—A steer badly locoed by the white loco weed, *Oxytropis lambertii*

In Figure 17 is shown a steer poisoned by the blue loco weed. Figure 18 is a picture of a steer in the last stages of loco poisoning from

eating white loco weed. Figure 19 is a locoed range horse, probably affected by the blue loco weed. In Figure 20 are shown two horses poisoned by the purple loco weed. These pictures show very well the lack of muscular coordination which is one of the striking symptoms in locoed animals.

The losses from loco plants have been enormous. Some owners have gone into bankruptcy, and in many cases it has been found impossible to run horses or cattle on certain ranges.

FIGURE 19.—A locoed horse in Arizona. The attitude is typical

### TREATMENT OF ANIMALS POISONED BY LOCO WEEDS

It does not always follow that animals eat the plants in any very large quantity, for even in a place like that shown in Plate 16 cattle may be pastured for a long time without becoming affected. The most important point in regard to the handling of domestic animals on such a loco range, as will be emphasized later in this bulletin, is to see that they have an abundance of good feed. When the range contains in addition to the loco an abundance of grasses the number of locoed animals is very much reduced.

When the first symptoms of loco poisoning are observed, it is essential that the animals be removed to a place where they can not get the plants. Horses are very apt, after becoming slightly locoed, to continue eating the plant until they are absolutely worthless. It is always unsafe to keep a partly locoed horse on ground that is covered with the plant. The same is true in regard to cattle, only to a lesser degree. As soon as symptoms of loco poisoning are seen in cattle they should be removed from the open range and, if possible, put on alfalfa pasture. All locoed animals are constipated, and the alfalfa has a tendency to relieve this condition.

FIGURE 20.—Locoed horses in western Nebraska, showing lack of muscular coordination

Generally speaking, if cattle are moved from the open range in time and fed on alfalfa, most of them will recover. After recovery

it is well to put them on the market as soon as possible, for if turned out on the range again there is always a possibility that they may become locoed a second time, with worse results than at first.

If the animals are valuable enough to justify the time spent in treating them, their recovery will be hastened, in the case of horses, by daily doses of from 15 to 20 cubic centimeters (4 to 6 drams) of Fowler's solution, while cattle may be given hypodermic injections of strychnine. These doses should be continued for at least a month. Care should be taken in the use of strychnine, as locoed animals are very sensitive to its use. It is better that doses for cattle should not exceed three-twentieths or four-twentieths of a grain. Never, in the case of a large animal, should more than one-half grain be given.

In the case of locoed sheep upon the range, if the number is small, it is not profitable to spend any time or trouble with them. It is better to slaughter them immediately, as a locoed sheep will teach others the same habit. If, however, a number of locoed sheep can be separated and, like the cattle, be turned into an alfalfa field, most of them are likely to recover. Sheep may be helped by doses of one-twentieth grain of strychnine, but ordinarily, on account of the small value of individual animals, it is not profitable to spend the time necessary to insure their recovery.

In handling animals in a loco country it should be remembered that all domestic animals are more or less imitative, and loco eaters are likely to teach others to do the same thing. Therefore, so far as possible, all animals that have acquired the habit of loco eating should be separated from the others.

## THE BUCKTHORN FAMILY (RHAMNACEAE)

### COYOTILLO (KARWINSKIA HUMBOLDTIANA)

Coyotillo is a shrub from 3 to 20 feet in height, growing abundantly in southwestern Texas and found in Lower California and in Mexico. It can be rather readily recognized by the form of the leaves, which are from 1 to 3 inches long, green above, and paler beneath. The leaves and fruit are shown in Plate 30 and a plant at the time of blossoming in Figure 21. The common name in Texas is coyotillo, but it is known by a number of other names, among them being callotia, coyotio, cayote, riventdore, margarita, and gallita.

Although the leaves are somewhat poisonous, the harmful effects on livestock on the range are produced mainly, if not entirely, by the fruit, and in the latter the poisonous properties are principally in the stones and seed.

Animals poisoned by coyotillo suffer from paralysis, especially noticeable in the hind legs. Cattle affected by it are popularly said to have the "limber-leg" disease. Apparently it does not produce pain and the poisoned animals may live a long time if supplied with feed and water, although in bad cases they are unable to move about. A chronic condition of more or less complete paralysis is produced, from which the victims may recover, but ordinarily do not. Experiments have proved that the plant is poisonous to cattle, sheep, goats, guinea pigs, and chickens, and there are reliable reports of poisoned swine and horses.

COYOTILLO (KARWINSKIA HUMBOLDTIANA)

Showing the leaves and fruit.

A somewhat peculiar characteristic of coyotillo poisoning is that while it may result from a single feeding, the symptoms may not appear for several days or even weeks. Cases of serious poisoning of children have also been reported.

## THE PARSLEY FAMILY (APIACEAE)

### WATER HEMLOCK (SPECIES OF CICUTA)

The most poisonous of all the plants in the United States are, without any doubt, the water hemlocks belonging to the genus Cicuta. They are commonly but erroneously known throughout the West as parsnip. Several species of Cicuta are recognized by botanists, but they are very closely allied, and for the purpose of stockmen the description of one will serve for all. Plates 31 and 32 show tuber water hemlock, *Cicuta vagans*, the species which is common on the Pacific slope, while Plate 33 shows the stems and roots of the species growing further east, spotted water hemlock, *C. maculata.*

FIGURE 21.—A plant of coyotillo, *Karwinskia humboldtiana*, at the time of blossoming

Cicuta is an umbelliferous plant growing in swamps and damp valleys and frequently very abundantly along irrigating ditches. A large number of umbelliferous plants occur in these localities, and it is difficult for one unacquainted with botany to distinguish Cicuta from similar but nonpoisonous plants. Probably the easy way to distinguish the plant is by an examination of the rootstock. The Cicuta grows from a rootstock to which are attached roots which may be small (pl. 32), or may take the form of a group of thick, fleshy tubers (pl. 33). In longitudinal section this rootstock shows more or less distinctly a number of transverse chambers. (Pl. 32.) By this peculiarity of structure Cicuta can be distinguished from most plants growing in places where it is likely to be found.

#### POISONING BY CICUTA

It has been commonly thought that the tops of Cicuta when found in hay caused the loss of stock, but experimental work of the department has shown quite conclusively that the mature tops and seeds never occasion losses, although cases of poisoning have resulted from eating the young shoots in the spring. The rootstock and roots are violently poisonous and a very small quantity is sufficient to kill any animal that eats them. Probably all animals are susceptible to the effects of this plant. The losses of domestic animals are mainly of cattle which either obtain the rootstocks that have been plowed up

TUBER WATER HEMLOCK (CICUTA VAGANS)

The species of Cicuta growing in the northwestern part of the United States. Cicuta, commonly known to stockmen as parsnip, is the most poisonous of all our native plants, and grows in damp valleys and along irrigating ditches

TUBER WATER HEMLOCK (CICUTA) VAGANS

A young plant with the rootstock, and a longitudinal section of the rootstock. By the transverse chambers shown in the longitudinal section of the rootstock the Cicuta can readily be distinguished from any other plant growing in the same locality

along irrigating ditches or find them along watercourses in mountain valleys where they have been washed out by the high water.

### Symptoms, Treatment, and Losses

The symptoms of Cicuta poisoning are frothing at the mouth and most violent convulsions, which in a short time ordinarily end in death. Figure 22 shows a calf in convulsions as the result of eating water hemlock.

When cattle are severely poisoned the convulsions are so violent that it is almost impossible to administer a remedy; in fact, no effective remedy is known, and death is almost certain to follow cases of severe poisoning by this plant.

It frequently happens that human beings, especially children, are poisoned by Cicuta, in which case if an emetic can be given promptly, so that the stomach is quickly emptied, recovery usually takes place. Because of the fact that ruminant animals can not empty the stomach by vomiting, this remedy can not be applied to them.

Figure 22.—Calf in convulsions resulting from poisoning by spotted water hemlock, *Cicuta maculata*

The losses from Cicuta poisoning are not ordinarily very heavy, but the individual stockmen occasionally lose a considerable number of animals.

## THE HEATH FAMILY (ERICACEAE)

Among the plants of the heath family are a number commonly but erroneously called laurels which are important as poisonous plants and occasion heavy losses, more especially of sheep. All these plants contain a poisonous substance known as andromedotoxin. The following brief statements concern the species which are known to cause losses on the western ranges.

### Menziesia glabella

*Menziesia glabella*, a shrub which grows in the mountains of the extreme Northwest, has been found to be distinctly poisonous to sheep. It is not known that many losses have occurred from eating this plant, but it was demonstrated in one case in Idaho that the plant was the cause of very heavy losses, and there is no doubt that when sheep in those regions are pastured on the north slopes where Menziesia is more likely to grow, and are short of other food, disastrous results may follow. Plate 34 shows this plant in flower.

### Black Laurel (Leucothoë davisiae)

*Leucothoë davisiae*, generally known throughout the Sierras as black laurel, is particularly destructive to sheep. It has thick, dark-green oval leaves and small white flowers in erect racemes (pl. 35) and

MENZIESIA GLABELLA

One of the so-called laurels growing in the northwestern part of the United States, which has been known to occasion heavy losses of sheep.

BLACK LAUREL (LEUCOTHOË DAVISIAE)

This plant causes heavy losses of sheep in the Sierras.

grows to a height of about 3 or 4 feet. It is found in small patches at elevations of from 3,500 to 5,000 feet in the northern Sierras in California. While far from common, it is yet a very important plant, because of its extremely toxic character. It has been stated that a single leaf will poison a sheep. This statement is probably exaggerated, but experimental work shows that very small quantities will poison sheep and that death may be produced by between 1 and 2 ounces. The prominent symptoms are salivation, nausea accompanied with vomiting, depression, weakness, and irregular respiration. Figure 23 shows a slightly poisoned sheep.

### Labrador Tea (Ledum glandulosum)

Labrador tea (pl. 36) is also known in California as black laurel and probably is not generally distinguished from *Leucothoë davisiae* by the sheepmen, although it has a very different habit. It is rather widely distributed, being found not only in the Sierras and coast ranges in California, but also in Oregon, Washington, Nevada, and the Rocky Mountains. This plant has been considered as dangerous as *L. davisiae*. Experimental work has shown, however, that it is very slightly toxic, and probably never makes trouble under range conditions. It is well for the stock people to familiarize themselves with the evident differences between Labrador tea and *L. davisiae*.

Figure 28.—A sheep poisoned by black laurel, *Leucothoë davisiae*, showing salivation

### Rhododendron albiflorum

*Rhododendron albiflorum* (pl. 37) is common in the mountains of the Northwest and has undoubtedly caused some losses, although it is not very generally recognized as a poisonous plant. Experiments apparently show that it is more poisonous than Menziesia, but less so than the black laurel. Losses from this plant have been reported from the Columbia National Forest, in Washington, and from the Routt National Forest, in Colorado.

### Western Azalea (Azalea occidentalis)

The western azalea, *Azalea occidentalis*, sometimes called white laurel (pl. 38), is found in the coast ranges and the Sierras, growing at a slightly lower level than the black laurel, and causes considerable losses of sheep.

LABRADOR TEA (LEDUM GLANDULOSUM)

Commonly called black laurel and not distinguished from *Leucothoë davisiae*. It is only slightly toxic.

RHODODENDRON ALBIFLORUM

This plant causes losses of sheep in the Northwest.

### Symptoms of Laurel Poisoning

The symptoms are practically the same in all cases of so-called laurel poisoning. There is salivation resulting in frothing at the mouth (fig. 23), nausea ordinarily accompanied with vomiting, depression, weakness shown by a staggering gait or inability to stand, and irregular respiration. Grinding of the teeth is frequently noticed in sick animals.

### Treatment of Laurel Poisoning

Little can be done in the way of remedial treatment. Anything that will aid in elimination will be of some benefit, and to this end purgatives may be given, such as Epsom salt in doses of 4 ounces. The main reliance, however, must be placed on prevention. Herders should learn to recognize and avoid the plants.

## THE MILKWEED FAMILY (ASCLEPIADACEAE)

### MILKWEED (SPECIES OF ASCLEPIAS)

A large number of species of milkweed are poisonous and cause losses of livestock, especially of sheep.

FIGURE 24.—A sheep severely poisoned by woolly-pod milkweed, *Asclepias eriocarpa*

### Whorled Milkweed

There are several species of whorled milkweed, plants with narrow leaves arranged more or less in whorls. Of these the most important is horsetail milkweed, *Asclepias galioides* (pl. 39), found in Colorado, Utah, Arizona, and New Mexico, and extending into western Texas. It is poisonous to horses, cattle, and sheep, and has caused serious losses, especially of sheep.

Another whorled milkweed, the Mexican milkweed, *A. mexicana* (pl. 40), grows in the Pacific States and is especially abundant in some parts of California. It is not so poisonous as *A. galioides*, but nevertheless has caused serious trouble.

The most characteristic symptom in acute cases of poisoning by the whorled milkweeds is the presence of most violent convulsions, sometimes accompanied by a very high temperature. In milder cases the animals do not exhibit convulsions, but stagger about, the weakness being most pronounced in the hind legs. This condition may be prolonged several days.

In Figure 24 is shown a sheep poisoned by the woolly-pod milkweed; and in Figure 25, a sheep in violent convulsions as the result of poisoning by the Mexican milkweed. Figure 26 shows a sheep poisoned by the Plains milkweed *Asclepias pumila*; the animal has difficulty in standing, as indicated by the bracing apart of the hind

WESTERN AZALEA (AZALEA OCCIDENTALIS)

It grows at a lower elevation than the black laurel and causes heavy losses of sheep in the Sierras

HORSETAIL MILKWEED (ASCLEPIAS GALIOIDES)

This plant is very poisonous to cattle, horses, and sheep, and has caused some extremely heavy losses of sheep in the West and Southwest.

THE MEXICAN MILKWEED (ASCLEPIAS MEXICANA)

This species is especially abundant in parts of California.

legs. In Figure 27 is shown a horse poisoned by *A. galioides*. In spite of the extreme illness, this animal recovered.

### Woolly-Pod Milkweed (Asclepias eriocarpa)

A broad-leafed milkweed, *Asclepias eriocarpa*, known as the woolly-pod milkweed (pl. 41), which grows in California, is very poisonous and has caused heavy losses of sheep. The prominent symptoms of poisoning by woolly-pod milkweed are marked depression, loss of appetite, diarrhea, mucus in feces, lowered temperature, and rapid pulse. This is probably the most poisonous of all the milkweeds.

Figure 25.—Sheep poisoned by Mexican milkweed

### Other Broad-Leafed Milkweeds

Recent studies have shown that there is danger from other broad-leafed milkweeds, though some, apparently, are harmless. It is difficult for one not well informed in botany to distinguish between these plants, and, in the present state of our knowledge, it is best that the stockman should prevent extensive grazing on any of these plants.

Figure 26.—A sheep poisoned by the Plains milkweed, *Asclepias pumila*. The weakened condition of the hind legs is noticeable, as in the Mexican milkweed case

### Milkweeds Not Sought by Animals

The milkweeds are distasteful to animals and are never eaten by choice. When, however, hungry stock are confined to areas where milkweeds are abundant, they will eat them for lack of better forage and frequently with disastrous results. There is little danger from any form of milkweed so long as animals are well fed.

There is no known successful way of treating milkweed poisoning, except by prevention.

THE WOOLLY-POD MILKWEED (ASCLEPIAS ERIOCARPA)

An exceedingly poisonous plant growing in western and southern California.

## THE NIGHTSHADE OR POTATO FAMILY (SOLANACEAE)

The nightshade family contains many plants poisonous to stock, the best known perhaps being the jimson weed, *Datura stramonium*, an introduced plant which has made itself at home in the United States, especially in the South. However, the only plants of this family which have caused trouble, under range conditions, are the wild tobaccos, *Nicotiana trigonophylla*, found in southern Nevada, Utah, Colorado, and Mexico, and east to central Texas, and *N. attenuata*, found from Washington to Mexico and east to central Colorado; they have been shown to be poisonous to cattle, sheep, and horses, and *N. trigonophylla* is known to have caused considerable losses of cattle and sheep in New Mexico. The plants cause the typical symptoms of nicotine poisoning, cattle and horses being more susceptible than sheep. While presumably the tobaccos are distasteful to grazing animals, when other forage is scarce, they may eat considerable quantities, enough to cause sickness or death. *N. attenuata* (pl. 42), plants are easily recognized by their resemblance in form and odor to cultivated tobacco. They ordinarily grow in small, thick patches, and under such conditions can readily be destroyed, as they are annuals and only need to be cut down before the seeds are formed.

FIGURE 27.—A horse poisoned by the horsetail milkweed, *Asclepias galioides*. The violent convulsions are characteristic of poisoning by the whorled milkweeds

## THE ASTER FAMILY (ASTERACEAE)

### COCKLEBUR (SPECIES OF XANTHIUM)

The cocklebur or clotbur (fig. 28), is represented by a number of species (*Xanthium* spp.), is very widely distributed, and has been the cause of losses of cattle and swine in many localities, especially in Oklahoma, Texas, and New Mexico. While long supposed to be poisonous, it is only very recently that definite, experimental proof of its toxic character has been obtained.

It is said that the burs produce mechanical injury by irritating the alimentary canal or by becoming matted together to form balls which cause intestinal obstruction. It is claimed that there have been cases of the lodging of burs in the throat. Some recent authors have stated that the only injury produced by cocklebur is the mechanical effect. There is now, however, positive proof of the poisoning of swine, sheep, cattle, and chickens. There are reports also of the poisoning of horses. All the poisoning is by the young plant in the

A NATIVE SPECIES OF TOBACCO (NICOTIANA ATTENUATA)

This picture shows the forms of the leaves and flowers.

WESTERN SNEEZEWEED (HELENIUM HOOPESII)

This plant, especially in Utah, causes serious losses of sheep

cotyledon stage. Young pigs are especially susceptible to the plant and have been lost in great numbers. Figure 29 shows a pig fatally poisoned. While the plant has been shown to be poisonous to sheep, there have been no reports of losses of sheep under range conditions, but the burs produce trouble by becoming tangled in the wool and causing a considerable dockage.

FIGURE 28.—A branch of a common cocklebur, *Xanthium italicum*, showing the form of the leaves and fruit

REMEDIES

Experimental work has shown that beneficial results follow the administration of oils or fats. For this purpose linseed oil, bacon grease, or lard can be used.

### WESTERN SNEEZEWEED (HELENIUM HOOPESII)

Western sneezewood, *Helenium hoopesii*, sometimes called yellowweed by the stockmen, is found in great abundance on the sheep ranges of the Wasatch Mountains, Utah, especially in localities where the range has been heavily grazed. The plant is distributed in greater or less numbers from Wyoming to New Mexico and Arizona, and as far west as California, but it is in Utah that it has become prominent as a poisonous plant.

FIGURE 29.—A young pig fatally poisoned by cocklebur. The picture was taken shortly before death

The plant (Pls. 43 and 44), is a stout, perennial composite, growing to 2 or 3 feet in height, with thick, deep-green leaves. The rays of the flower are of an orange color and the disk a brownish orange; the blossoming period in the Wasatch Mountains ends the middle or last of August. Its range in elevation is from 7,000 to 10,500 feet.

Under ordinary range conditions the western sneezewood seems to be dangerous to sheep only, although there have been some fairly well-authenticated losses of cattle from this plant. It has been found to be the cause of what is known in Utah as the "spewing sickness" of sheep, from which there have been quite heavy losses.

WESTERN SNEEZEWEED (HELENIUM HOOPESII)

This picture shows how thickly it grows where land is heavily grazed.

### Symptoms of Poisoning by Western Sneezeweed

The marked symptoms of sneezeweed poisoning are depression, weakness, salivation, and nausea accompanied with vomiting; the latter symptom is so prominent as to have given the disease its popular name. Diarrhea is common, and bloating is a prominent symptom in the animals poisoned on the range. The poison is cumulative, and its effects continue for a long time.

Figure 30 shows a sheep poisoned by *H. hoopesii* at a time when nausea is very apparent, and Figure 31 shows a steer in the act of retching as the result of feeding on this plant.

Figure 30.—A sheep poisoned by western sneezeweed, *Helenium hoopesii*. Its attitude shows that it is nauseated

### Treatment for Sneezeweed Poisoning

No medicinal remedy for sneezeweed poisoning has been found. It is the custom of sheepmen on the Wasatch Mountains, when their sheep are found to be "spewing," to take them to lower altitudes on "browse range," when their condition is improved. It is recognized, however, that this treatment does not effect a real cure. It is important that herders should recognize the plant and so far as possible avoid ranges or parts of ranges where it is especially abundant. Generally speaking, when sheep are found to be suffering from this plant it is because they have been eating it for some time, and perhaps a single, large feeding may have precipitated the trouble, which is mainly due to the accumulated effect of prolonged feeding.

Figure 31.—A steer which has eaten western sneezeweed and is suffering from severe retching

### BACCHARIS RAMULOSA

*Baccharis ramulosa* (pls. 45 and 46) is a spreading shrub from 1 to 2 feet in height, found in western Texas, the southern portions of

BACCHARIS RAMULOSA

The female plant in blossom.

BACCHARIS RAMULOSA

The male plant in blossom.

PARRY ASTER (ASTER PARRYI)

The Parry aster is supposed to have caused losses of sheep in Wyoming. It is probable that sheep eat it only when there is a lack of other forage.

RUBBER WEED (ACTINEA RICHARDSONI)

For a long time the rubber weed has been believed to cause losses of sheep in northern New Mexico and southern Colorado

New Mexico and Arizona, and in Mexico. The tips of the young branches are sticky. The leaves are small, from one-eighth to three-quarters of an inch long, and grow in dense clusters. The flowers are in bell-shaped heads terminating the branchlets. The staminate and pistillate flowers are on different plants. The white pappus of the pistillate flowers makes the plants, when in blossom, conspicuous. The plants may live at altitudes of from 4,000 to 7,600 feet, but are more commonly found between 5,000 and 6,000 feet.

There is good reason for thinking that this plant is responsible for many losses of cattle from October to midwinter, at a time when other forage is scarce. Experimental work has shown definitely that it is poisonous to sheep, the toxic dose being about 1 pound for a 100-pound sheep. Care should be taken that stock, especially when poorly nourished, should not graze to any extent on this plant.

From what is known of *B. ramulosa*, it seems that it would not be difficult to remove it from a range, as it is local in distribution and easily destroyed by a mattock.

#### PARRY ASTER (ASTER PARRYI)

Parry aster, sometimes called woody aster, *Aster parryi* (pl. 47), occurs in great abundance in certain regions in Wyoming, and has been accused of causing losses of sheep in those localities. There is no doubt that the plant is poisonous. It is a fibrous plant, however, and is very distasteful to sheep under ordinary circumstances, so that there is very little danger from it provided the sheep are kept in a region where sufficient feed is obtainable.

#### COLORADO RUBBER WEED (ACTINEA RICHARDSONI)

The Colorado rubber weed, or pingue, *Actinea richardsoni* (pl. 48), is confined to the northern part of New Mexico and southern Colorado and Utah, and in certain localities grows in very great abundance. Its asterlike flowers are conspicuous, and the plant is readily distinguished from similar plants because of the dark golden-yellow color of the flowers and a distinctive odor. The plant has had a good deal of advertising because it contains a certain amount of rubber and has been the subject of commercial exploitation. It is said, especially in southern Colorado and northern New Mexico, that sheep feeding on this plant late in the winter suffer severely.

Experimental work has proved that the plant is poisonous to sheep, but it has been found difficult, under corral conditions, to make them eat it. Field observations have shown that in the localities where animals are reported to have suffered, the sheep in the latter part of the winter are frequently kept under conditions closely approaching starvation, and at such times, doubtless by force of circumstances, they eat more of the plant. It is doubtful whether there would be any loss from the plant if the sheep were properly fed.

#### RAYLESS GOLDENROD (APLOPAPPUS HETEROPHYLLUS)

In the Pecos Valley in New Mexico and Texas there has been for many years a disease of animals, especially in cattle, known as milk sickness, alkali disease, and trembles. For a time it was supposed

RAYLESS GOLDENROD (APLOPAPPUS HETEROPHYLLUS)

Upper, a group of plants late in the fall; lower, a plant as seen after snowfall.

to be contagious, but it has been shown that it is produced by *A. heterophyllus*, popularly known as rayless goldenrod or jimmy weed. While the most serious effects of the weed in the Pecos Valley have been on cattle, it will poison also horses and sheep.

The plant (pl. 49) is a perennial, growing ordinarily to a height of 2 feet, but it may reach 4 feet or more. It is very abundant in some localities, frequently making a thick hedge along ditches.

One of the most prominent symptoms is the muscular trembling which has given rise to the name "trembles" as applied to the disease. It has been shown that sometimes the offspring are poisoned by the mother's milk.

Not only are calves poisoned by their mothers' milk, but it is generally known in the Pecos Valley, where it has been a serious handicap to the dairy business, that human beings may be affected by the use of milk or butter from sick cows.

Figure 32 shows a sheep poisoned by rayless goldenrod. The animal trembled violently and could stand only a minute or two. In Figure 33 is a steer in the last stages, shortly before death.

It is important that stockmen should make certain that their animals get no large quantity of the plant. If animals are found eating it they should be removed immediately to locations where there is none. In the early stages of the disease they recover very quickly if put on good pasture.

The plant is rather easily destroyed by grubbing out to a depth of 2 or 3 inches, and thoroughly cleared pastures remain clear for a long time.

Another rayless goldenrod, *A. fruticosus*, found in southern Arizona, produces the same harmful effect as *A. heterophyllus*.

FIGURE 32.—A sheep poisoned by rayless goldenrod, *Aplopappus heterophyllus*

## THE FERN FAMILY (POLYPODIACEAE)

### BRACKEN (PTERIDIUM AQUILINUM)

The common bracken (pl. 50) should be mentioned here as one of the poisonous plants, although the losses from it are probably not large. It has long been known abroad that this fern is poisonous to cattle and horses. There have been comparatively few reports in this country of such losses, and those are largely confined to the Northwest, where the form is *P. aquilinum pubescens*. There is no doubt that bracken will poison both cattle and horses, and probably sheep, and care should be taken that hungry animals do not have an opportunity to consume any large quantity.

## PREVENTION OF LOSSES

In a former bulletin [4] attention was directed to the fact that most of the losses from poisonous plants occur when the animals are short of feed, and it was suggested that the larger part of the stock poisoning is indirectly due to scarcity of proper forage. This fact of the intimate relation of scarcity of feed to stock poisoning can not be too strongly impressed on the people who handle range animals in the West.

There is apparently a popular idea that range animals will voluntarily seek out poisonous plants and eat them from preference. It may be stated as a general fact that this is not true. Animals seldom eat poisonous plants except as they are driven to do so by lack of other feed. Almost all poisonous plants are actually distasteful to livestock and under ordinary circumstances will be avoided. The only exception, perhaps, is the group of loco plants. Animals do frequently acquire a taste for loco and under some circumstances will eat nothing else, even in the presence of other forage; and yet the initial feeding in the case of loco plants is almost invariably brought about by scarcity of feed.

It has long been known that loco eating is ordinarily commenced in the winter season or in the early spring when the loco plants are green and luscious, and before the grass has started. The loco plants at that time are the most prominent plants on the plains, and animals commence to eat them because of lack of other feed. Many animals after feeding on loco a short time acquire a liking for it and will continue to eat it even in the presence of an abundance of other feed. This is not true, however, of all loco-eating animals, for there are very many which, after the grass has started, will leave the loco and will recover entirely from the effects which have been produced by the preceding feeding.

FIGURE 33.—A steer poisoned by rayless goldenrod, *Aplopappus heterophyllus, just before death*

In the matter of the other plants, the relation between starvation and the eating of the poisonous plant is still more marked. For instance, the larkspurs spring up immediately after the snow leaves the mountains and grow much more rapidly than the surrounding grasses, and if cattle are allowed to go to the upper ranges before the grasses have had a fair start, they find already occupying the ground the succulent larkspur plants in large numbers. Sometimes the cattle come from dry winter feed and are anxious to gorge themselves with any green material they find. Under such circumstances if they come upon a field of larkspur they

[4] MARSH, C. D. PREVENTION OF LOSSES OF LIVESTOCK FROM PLANT POISONING. U. S. Dept. Agr. Farmers' Bul. 720, 11 p. 1916.

COMMON BRACKEN (PTERIDIUM AQUILINUM)

The common bracken, particularly in the regions of the Northwest, sometimes causes losses of horses and cattle.

frequently eat enough to produce fatal consequences. Later in the season there is very much less danger from larkspur because of the abundance of other feed. If, however, cattle are driven from one range to another and the trail passes through a mass of tall larkspur, it is not at all unusual for the hungry animals to grab hastily at the plants, and this may result in disastrous consequences. Under such circumstances it is important that the cattle shall not be driven rapidly, for if so driven they will snatch all the more. They should also have been thoroughly fed before going on such a drive.

This has been illustrated in certain places in Colorado, where it is customary to drive cattle from one range to another, and for years there were always heavy losses. In the old days it was the custom to gather the cattle together and rush them as rapidly as possible through the place where the tall larkspur was growing. Losses invariably occurred. In recent years, instead of gathering the cattle together they have been put through the drive in small numbers and have been allowed to feed before starting. They are not driven rapidly. Under such conditions no losses have occurred.

It is also evident, from what has been said earlier in this bulletin, that if cattle can be kept from fields of larkspur until after the plant has blossomed, little trouble may be expected. This method has been used for many years in certain regions in Colorado, where it is a common practice to "ride for poison," as it is called; that is, the herders ride and keep the cattle down from the higher ranges until the larkspur has blossomed and matured, after which there is no further danger. The same thing has been accomplished in certain regions by putting up drift fences which are designed to keep the cattle on the lower ranges until the danger is past. There are valleys known as death traps for cattle. Frequently it will be found that in these valleys the tall larkspur is thriving in large clumps, and cattle drifting in will feed freely upon it. It is often possible under such conditions to clear out this larkspur, or enough of it so there will be no danger. In order to kill the plants, the roots of most of the species should be cut off at least 6 or 8 inches below the surface.

The losses of sheep from death camas (Zygadenus) occur under very similar conditions to those of cattle from larkspur. The grassy death camas grows very early in the spring. It precedes the grasses in its growth and is present in a succulent condition at a time when other forage is extremely scarce. Inasmuch as it occurs frequently in large masses, if sheep are trailed over these places they are liable to get enough to cause heavy losses. It is particularly important in the handling of sheep in such localities that, if possible, they be grazed in loose order. In fact, this is true of the handling of sheep under all circumstances. When the animals are massed together they will eat everything in their course, and, because of jealousy, will take particular pains to get every available plant. If, on the other hand, they are kept in loose order and spread widely over the range, they are much less likely to eat any poisonous plant.

This applies equally well to lupine poisoning. When sheep are allowed to feed freely on a lupine patch and are moved without any haste, no harmful results will occur. If, however, they are massed together and driven in close formation over such a patch,

they are almost certain to be poisoned if the plants are in pod at the time. A large number of specific instances have been noted. At one place in Idaho, for instance, where losses have occurred repeatedly, it was found that the sheep were trailed in a narrow space through a patch of lupine. The remedy in such cases clearly is to see that the sheep, when it is necessary to trail them through a patch of lupine, are drifted rather than driven, and that they are well fed when they come upon the lupine area. It seems probable that intelligent handling of bands of sheep may reduce to almost nothing the losses occasioned by death camas and lupine. If, however, hungry sheep come in contact with fields of death camas in the spring, or with fields of lupine late in the summer and in the fall, at a time when the plants are bearing pods, fatal results must be expected.

In one locality in Oregon an instance of this character occurred in the summer of 1914, when about 4,000 sheep which had been driven rather rapidly along a trail where forage was scarce were turned into a 10-acre pasture on which there was little but sagebrush and lupine, the lupine at that time being in pod. About 400 out of the 4,000 sheep died. Similar instances may be cited in a large number of places. Sometimes successive bands of sheep are driven over a trail, several going without any loss whatever; then one band may suffer heavily, while others following are not harmed. The explanation of these cases seems to be that the first animals going over the trail avail themselves of all the useful forage. The succeeding animals, finding nothing suitable for feed, take the poisonous plants, which may be wild cherry or lupine, or, in the case of cattle, larkspur. The animals which are poisoned may exhaust the supply, even of the poisonous plants, so that succeeding bands are not poisoned and get across the trail safely provided they do not fall from actual starvation.

It follows from these facts that it is very undesirable to keep sheep for any length of time on the same bedding ground. It has been shown to be bad for the range on general principles, but it is also rather risky for the sheep themselves, for if animals go out from the same place day after day and return at night they will eat everything that is available along the route. In such cases, if there are poisonous plants to be obtained, the animals are apt at some time to get hold of them, with disastrous results. This has been very clearly shown in a case of Menziesia poisoning, in which animals were bedded on a forest range for five nights in the same place; the animals were safe for the first two nights, but after that there was heavy loss. At the same time a band that was wandering about without a herder in the same region was uninjured.

It can not be too strongly impressed on persons handling sheep on the range that the sheep should be allowed to graze as far as possible under strictly natural conditions. By this is meant that they should be allowed to go freely, separated from one another, moving slowly, and not permitted to graze over and over on the same ground. The so-called blanket system of herding, which is advocated by the Forest Service, in addition to the fact that it aids in the conservation of the range, also without any doubt reduces the losses from poisonous plants to a minimum, if it does not entirely do away with them.

In conclusion, it should be stated that, generally speaking, very little must be expected from medicinal remedies to reduce the losses from poisonous plants. It is true that such remedies will help in the case of locoed animals and will save life in the case of larkspur poisoning of cattle. Generally speaking, however, the reliance should be placed, not in remedies but on prevention. Animals must be so well cared for that they will not be tempted to eat poisonous plants. Something may be done in the way of eradication, as was indicated under the discussion of larkspur. Larkspur can doubtless be eradicated within a limited area. The locoes in pastures can be eradicated with very little difficulty, but on the open range dependence must be placed on avoidance rather than eradication. Death camas, too, does its harm on the open range, and there it occurs in such large masses that eradication is impossible. In the matter of Cicuta, farmers, without doubt, may accomplish much by digging it up along their irrigation ditches, and this practice is usual in a great many localities. But in the main the losses from poisonous plants must be prevented by careful handling of the herds, it being remembered always that animals are not likely to eat poisonous plants from preference, but that under starvation conditions they may be driven to the use of such material for forage, with most disastrous results.

## ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

October 3, 1929

| | |
|---|---|
| *Secretary of Agriculture* | ARTHUR M. HYDE. |
| *Assistant Secretary* | R. W. DUNLAP. |
| *Director of Scientific Work* | A. F. WOODS. |
| *Director of Regulatory Work* | WALTER G. CAMPBELL. |
| *Director of Extension Work* | C. W. WARBURTON. |
| *Director of Personnel and Business Administration.* | W. W. STOCKBERGER. |
| *Director of Information* | M. S. EISENHOWER. |
| *Solicitor* | R. W. WILLIAMS. |
| *Weather Bureau* | CHARLES F. MARVIN, *Chief.* |
| *Bureau of Animal Industry* | JOHN R. MOHLER, *Chief.* |
| *Bureau of Dairy Industry* | O. E. REED, *Chief.* |
| *Bureau of Plant Industry* | WILLIAM A. TAYLOR, *Chief.* |
| *Forest Service* | R. Y. STUART, *Chief.* |
| *Bureau of Chemistry and Soils* | H. G. KNIGHT, *Chief.* |
| *Bureau of Entomology* | C. L. MARLATT, *Chief.* |
| *Bureau of Biological Survey* | PAUL G. REDINGTON, *Chief.* |
| *Bureau of Public Roads* | THOMAS H. MACDONALD, *Chief.* |
| *Bureau of Agricultural Economics* | NILS A. OLSEN, *Chief.* |
| *Bureau of Home Economics* | LOUISE STANLEY, *Chief.* |
| *Plant Quarantine and Control Administration* | C. L. MARLATT, *Chief.* |
| *Grain Futures Administration* | J. W. T. DUVEL, *Chief.* |
| *Food, Drug, and Insecticide Administration* | WALTER G. CAMPBELL, *Director of Regulatory Work, in Charge.* |
| *Office of Experiment Stations* | E. W. ALLEN, *Chief.* |
| *Office of Cooperative Extension Work* | C. B. SMITH, *Chief.* |
| *Library* | CLARIBEL R. BARNETT, *Librarian.* |

This bulletin is a contribution from

| | |
|---|---|
| *Bureau of Animal Industry* | JOHN R. MOHLER, *Chief.* |
| *Pathological Division* | JOHN S. BUCKLEY, *Chief.* |



U. S. GOVERNMENT PRINTING OFFICE: 1929